Sedimentology of the Fluvial Deposits of the Nýřany Member, Kladno-Rakovník Basin, Central Bohemia

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The aim of my investigation is to define mechanisms of sedimentation, directions of the paleoflows, fluvial style and its changes, tectonic deformation and its causes in Nýřany Member (Westphalian D- Cantabrian) on the eastern margin of Kladno–Rakovník Basin (in the area between Kralupy nad Vltavou and Nelahozeves). Sedimentological results based on the study of Hostibejk Hill are presented here.

Four sedimentary facies were defined:

Facies A: laminated claystones to clayey-sandstones. This facies is interpreted as sedimentation from suspension.

Facies B: medium-grained sandstones to fine-grained conglomerates with coal interbeds in places, trough cross-bedded with pronounced erosional base. The erosional relief is 0.25–1.2 m. Cobbles at the base. Average size of clasts is 2.1 cm, maximal size is 10 cm. Rip-up sandstone clasts up to 35 cm are presented rarely. This facies is interpreted as sedimentation from traction current, migration of 3D-dunes.

Facies C: medium-grained sandstones to fine-grained conglomerates with planar cross- bedding and plain erosional base. The erosional relief is 0.1–0.25 m. Cobbles at the base in places. Some beds appear massive. Average size of clasts is 2.5 cm, maximal size is 8 cm. This facies is interpreted as sedimentation from traction current, migration of bedforms.

Facies D: medium-grained to cobbly conglomerates with coarse-grained sandy matrix, grain supported, cross-bedding. The erosional base has the relief ca. 1 m. Average size of clasts is 5.2 cm, maximal size is 15 cm. This facies is interpreted as sedimentation from traction current.

Photomosaics of Hostibejk Hill outcrops (height ~10 m, discontinuous length ~120 m – outcrops partly scrubby and covered) was made and three types of geometries (architectural elements) was defined:

1) Bodies (thickness ~3 m, length ~50 m) with pronounced erosional base, with the erosional relief up to 2.5 m, with multi-storey filling of facies B and D. Individual beds are separated by erosional surfaces. These bodies are interpreted as fluvial channels.
2) Bodies (thickness ~5 m, length ~30 m) with plain erosional base (erosional relief up to 1.4 m) composed of facies C. Individual sets of cross-bedding are separated by reactivation surfaces. These bodies are interpreted as bars.
3) Sheet bodies (thickness ~0.2 m, length ~3 m) composed of facies A often eroded by elements 1) and 2). Because of absence of bioturbation and roots, these bodies are interpreted as abandoned fluvial channels.

Predominantly NNE directions of paleoflows were found. The paleoflow vectors show low spread (ca. 20°).

Based on the multi-storey channel fills, large sizes of erosional reliefs, low spread of directions of the paleoflows, the absence of point bars, very rare preservation of ripples, the absence of lateral accretion and overall coarse grain size of the deposits we can interpret deposits of the Nýřany Member as a product of braided stream sedimentation. Further investigation will be focused on the Lobeč Hill outcrops (height ~50 m, length ~1000 m) and to analysis of AMS (anisotropy of magnetic susceptibility) which should either define directions of the paleoflows or deformation overprint.

Structural Development of the Outer Carpathians (Polish Segment): Progress Report

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This paper presents the results of our structural and mapping research during the last 7 years.

Regional setting

The Polish segment of the Outer Carpathians is a north-verging thrust-and-fold belt composed of several nappes. The main structural features of the belt were formed during Tertiary times when the belt was an accretionary prism related to southward directed subduction of the European Platform below the ALCAPA unit.

Structural approach

Starting point

Seven years ago the structural development of the Outer Carpathians has been rather poorly understood. The basic questions "how? why? and when? the tectonic features were formed" have been hardly answered. Even less has been known about the conditions of deformation.

How was it?

Structural analysis has been performed in c. 150 exposures. The results (Decker et al., 1997; 1999) show that the Outer Carpathian nappes were thrusted twice, first towards the NW and later towards the NE. The reasons for this scenario could have been twofold: either the far-field stresses rotated CW or the Carpathians rotated CCW. We have used paleomagnetic analysis to answer this question.

Why did it happen this way ?

Over 40 paleomagnetic sites have yielded positive results, all pointing to moderate to major CCW rotations during the Neogene times (e.g. Márton et al., 1999). It follows that the apparent change of direction of nappe thrusting is an artifact related to CCW rotation of the Carpathians.

When did it happen ?

To obtain precise dating we have studied deformation in relation to increasing induration of the strata involved. In this way it was possible to distinguish: (1) the synsedimentary structures, (2) structures formed during strata induration and, (3) structures formed in completely indurated strata. This research is most advanced in the Magura nappe. The results show that within the nappe, folding and thrusting were initiated during the Paleocene (Tokarski and Świerczewska, 1998) and completed during Late Eocene-Oligocene times (Świerczewska and Tokarski, 1998).

In what conditions did it take place?

We have attempted to quantify the temperatures and pressures by analyzing: (1) the composition of mixed-layer mineral (illite-smectite) and (2) fluid inclusions in mineral veins. The analysis of illite-smectite composition is completed for the Skole nappe (Dudek and Świerczewska, 2000) and considerably advanced for other nappes. The results show the decrease of diagenetic grade across the belt outwards and significant erosion pre-dating sedimentation of Miocene strata in intramontane depressions. During sedimentation, the strata of the Magura nappe were folded, thrusted and buried up to depth equivalent to temperatures 120–165 °C. The pilot data indicate maximum burial temperatures of 120–165° for the Dukla nappe and <120 °C for the Silesian nappe. The strata of the Skole nappe were subjected only to temperatures less than 80 °C. The analysis of fluid inclusions is considerably advanced for the Magura and Dukla nappes (eg. Świerczewska et al., 1999). The results show that during folding precipitation of calcite veins started at low temperatures (<50 °C) and continued to at least 145 °C. After folding, the majority of calcite veins crystallized at minimum temperatures of 90–140 °C. This late calcite precipitation was interrupted by high temperature (up to 220 °C) calcite-quartz mineralization episode. Strong fluctuations of fluid pressure (0.7–3.7 kbar) occurred during the last episode.

Cartographic approach

Two significant observations have been made during the reported period. (1) In the western part of the studied area, the basal Carpathian overthrust is underlied by Pannonian strata of the Carpathian Foredeep. This observation indicates that the age of completion of Carpathian thrusting is other than it has been accepted so far. (2) Numerous Late Eocene to Miocene olistostromes have been mapped. Most of them occur in front of the Magura and Silesian overthrusts and in tectonic windows within these two nappes. This results in major modification of maps, especially in the frontal part of the Magura nappe.

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